The Pervemac II project and its actions regarding the sustainable use of pesticides on agricultural production, food safety and consumers health in Azores.

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Project aim

The aim of PERVERMAC II project is to promote food security and a more responsible agriculture through monitoring of the presence of residues pesticides, mycotoxins and heavy metals from agricultural products produced and imported consumed within the geographical scope of Azores Madeira, Canary Islands and Cape Verde archipelagos.

The main objectives of the project are:

- Sampling and analysis of product residues phytosanitary products, mycotoxins and heavy metals in vegetable products (fruits and vegetables) and cereals that represent the base of the food pyramid in the Azorean archipelago population.
- Promote technical assistance and training farmers on Terceira Island (Azores) to support and improve local production, based on minimum incidence of residues from the application of plant protection products.
- Assessment of risks related to ingestion of fruits, vegetables and cereals for the health of Azorean consumers and development of educational actions with students and for all consumers by promoting a healthy diet based on the consumption of fruits and vegetables lowest possible content of pesticide residues.

Material and methods

The project lasted four years (from 2017 to 2020) and 120 samples in total were collected within fruits, vegetables, cereals and wine (Fig. 1-2) on the supermarkets and in 2020 only 25 samples in Terceira Island. All samples were shipped (Fig.3) and analyzed in Madeira (Fig. 4-5), in a certificate official laboratory to investigate the presence of pesticide residues (Fig.6).

- Samples collection applying the Directive 2002/63/EC.
- Pesticides analysis applying the MRLSCAC/GL33-1999 (Recommended Methods Of Sampling for the Determination of pesticide residues for compliance with MRLS CAC/GL 33-1999).
- In the residues analysis of fruits and vegetables collected (Fig. 1) the methodology was based on the EN 15662:2008 (E): Foods of plant origin — Determination of pesticide residues will be made by using GC-MS and/or LC-MS(/MS) following acetonitrile extraction/partitioning and clean up by dispersive SPE - QuEChERS-method. The samples were thus submitted to three methods of analysis: QuEChERS and its adaptations involves the addition of a salt and a buffer and uses the partition liquid-liquid with acetonitrile, followed by a DSPE purification step (dispersive solid phase extraction). Dithiocarbammate was performed using CEN 12396-2: 1996 standard (CEN, 1996).
- Specific training for farmers and students.

Figure 1. Food collection in the supermarket.

Figure 2. Preparation and samples labelling for shipping and laboratory analysis.

Figure 3. Registration and packaging and preparation of samples for shipment.

Figure 4. Laboratory analysis.

Figure 5. Preparation of sample for laboratory analysis.

Results

The analysis of residues were made from the sampling of fruits, vegetables, tubers, wines and cereals, allowed the identification and quantification of active substances derived from chemicals and plant protection products in the analyzed products. Most of the samples showed levels below the Maximum Residue Limit (MRL) established by law.

- In 2017: only 9% of samples had detected violation.
- In 2018: the detected violations increased mainly due to the increase in the number of substances officially researched.
- In 2019: no samples has residues above MRL (Fig. 6)
- In 2020 only one sample was identified with residues above the legally defined MRL (Fig. 6).

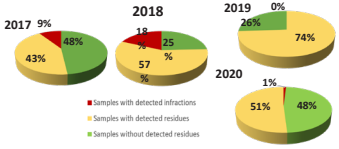

Figure 6. Relative percentage of residues found in the samples analysed in the different years.

Samples analyzed in relation to the dithiocarbamates (Fig. 7), their analysis is performed based on the determination of carbon sulfide (CS2) that can occur naturally in various products such as cabbages or turnips, making it impossible distinguish those who are exclusively released from digestion of dithiocarbamates from those resulting from poor agricultural practice by the farmer.

The presence of chlorate (Fig. 7) may be associated with the use of drinking water when washing products or using biocides in one or more stages of the production chain.

- Transfer of experience and knowledge (Fig. 8) and raising awareness among technicians and farmers about sustainable use of plant protection products in the Macaronesia.
- Demonstrative practices to technicians and farmers in the field (Fig. 8) in the Macaronesian region towards the sustainable use of plant protection products.

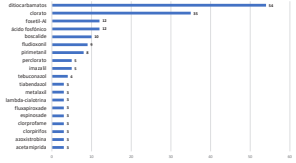

Figure 7. More frequente residues found in the samples analysed.

Figure 8. Manuals and actions for knowdlege tranfer to farmers .

Conclusions

This work will produce some changes in agricultural practices and pesticides application at farm level, thus avoiding any dangerous impacts that may have on human health.

The preparation of leaflets and a manual of good dietary practices will give rise to a new mentality of agricultural production and will allow to achieve a better and sustainable production, free of pesticides. Monitoring of residues in locally produced and imported agricultural products is a very important way of ensuring food security and the health of the Azorean population.

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